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The House Fly and Fowl Tapeworm Transmission.¹

JAMES E. ACKERT.

That chickens may be infested with tapeworms has long been known. In the United States seven different species have been taken from fowls, and in Kansas five of these species are commonly found. Chickens kept in small inclosures are less likely to be infested than are those which have free range of the premises. It is to the latter type, the general farm chicken, that most of the writer's attention has been directed. To date the entrails of 161 fowls from the farms in the vicinity of Manhattan, Kan., have been examined. From 121, or 75.1 per cent of them, tapeworms were removed. The infestation varied from 1 to 200 or 300, and in one instance a young chick contained 443 of these parasitic worms. Fourteen to twenty-seven worms are common, and this number may make a visible effect upon the fowl, causing emaciation, failure to develop feathers, and general debility. On the other hand, some fowls are strong enough to harbor as many as 40 of these worms and still have a healthy appearance. The average infestation for the 121 chickens was 26.7 worms per fowl. In this connection may be cited the case of a chick hatched on May 20, 1917. Two and one-sixth months later the chick was examined and the small intestine harbored a total of 443 tapeworms. This little chick was totally without feathers, except for a few which were distributed over the top of the wings and on a narrow strip on each side of the breast. The chick weighed four and one-half ounces. Three normal chicks from the same lot, which had been kept under the same conditions (the run of the place), weighed 20, 28 and 28 ounces, respectively.

It is well known that the tapeworm attaches its head or scolex to the intestinal wall of the host, that the segments which form in the region of the neck gradually develop both male and female organs, and that within a few weeks the most posterior segments become filled with eggs, or, rather, hooked embryos. At this time these gorged segments are ready to be broken from the tapeworm and passed to the exterior, where some of the embryos may be swallowed by a suitable intermediate host, in which the larval tapeworm, or bladder worm, can develop. When the intermediate host containing the bladder worm is eaten by the final host, the larval tapeworm attaches its head to the intestinal wall and develops into the adult worm.

The search for suitable intermediate hosts, or the means by which tapeworms are transmitted from one chicken to another, has been a baffling problem. Two Italian investigators, Grassi and Rovelli, in the decade preceding 1892, finally found that a garden slug (*Limax cinereus* Lister) may be the intermediate host of the fowl tapeworm (*Davainea proglottina* Davaine) that is of rare occurrence in this country. Meggitt, in England, and Gutberlet and the writer, in this country, have been continuing the search much of the time during the last five years.

In 1916 Gutberlet² reported that the house fly (*Musca domestica* Lin.) may be the intermediate host of a chicken tapeworm, *Choanotenia infundi-*

1. From the department of zoölogy, Agricultural Experiment Station of the Kansas State Agricultural College.

2. Gutberlet, J. E. 1916. Studies on the transmission and prevention of cestode infection in chickens. Jour. Am. Vet. Med. Assn., vol. 2, pp. 218-237.

buliformis (Goeze), but that he had failed to obtain any of the desired information on the remaining five species.

Among the small animals tested by the writer as possible intermediate hosts of these parasitic worms are crickets, three species of earthworms, house flies, May beetle larvæ, centipedes, sow bugs and four species of ground beetles, all of which are commonly found about rural poultry yards. Preliminary trials with the house fly in 1915 failed, but two years later experiments with this insect were resumed, with results showing that this fly may transmit another tapeworm, *Davainea cesticillus* (Molin), from one chicken to another.³

Similar experiments were continued in 1918, when it was found that the house fly is guilty of transmitting a third species of tapeworm, *Davainea tetragona* (Molin), from one fowl to another.⁴ The experiments also confirmed Gutberlet's evidence against this fly.

It is obvious that scrupulous care must be exercised in experiments of this nature. Chicks hatched in incubators were taken at once to a screened feeding house with cement floor and eighteen-inch walls, where they were given food free from animal tissues except occasional feedings of fresh beef and the suspected intermediate hosts. Control chicks were kept with the experimental ones, and these were free from parasitic worms in every case.

House flies taken from nature were placed in lantern-globe cages and given tapeworm embryos in small drops of sweetened water. They were then fed daily upon sweet milk or sirup for two weeks to permit the tapeworm embryos to grow to the bladder-worm stage, when the flies were either preserved for study or given to certain chickens in the experimental feeding house.

In 1918 the chickens at two local poultry yards were found to be heavily infested with the tapeworm *Davainea tetragona*. The most common invertebrates were the house flies which covered the freshly voided feces. Large fly traps were set at these places and thousands of flies trapped and brought to the laboratory, where they were immersed in water several hours to facilitate in picking out the house flies (*Musca domestica*), which were then given to chickens in the experimental feeding house. It was found that house flies which were immersed in water sixteen hours would fully recuperate in two and one-half to three hours after their removal from the water. This indicated that any tapeworm larvæ in their bodies were uninjured by the immersion. Approximately 3,000 such house flies were fed, a few at a time, to each of 16 chicks. As a result three of these chicks became infested with a total of fourteen mature tapeworms, which upon examination were found to be *Davainea tetragona*. Twelve control chicks running with the others were entirely free from parasitic worms.

The larva of this tapeworm has not yet been seen in the house fly, but a series of experiments has proved that the house fly does ingest this tapeworm's embryos, and that the latter do not pass through the fly's alimentary canal unaltered.

SUMMARY.

1. Seven species of tapeworms are known to occur in fowls in the United States, and five of these have been collected in Kansas.

3. Ackert, James E. 1918. On the life cycle of the fowl cestode *Davainea cesticillus* (Molin). Jour. Parasit., vol. 5, pp. 41-43.

4. Ackert, James E. 1919. On the life history of *Davainea tetragona* (Molin), a fowl tapeworm. Jour. Parasit., vol. 6, pp. 28-34.

2. Examinations of 161 spring chickens from farms near Manhattan, Kan., showed that 75.1 per cent of them were infested with tapeworms. The amount of infestation may vary from 1 to as many as 443 tapeworms; 10 to 27 are of more common occurrence, the average for infested fowls examined being 26.7 worms.

3. Tapeworms are transmitted from one chicken to another by means of an intermediate host in which the larval worm develops. The house fly (*Musca domestica* Lin.) is now known to transmit from one fowl to another three different species of tapeworms, viz., *Choanotænia infundibuliformis*, *Davainea cesticillus*, and *Davainea tetragona*.

Studies on the Occurrence and Development of *Ascaridia Perspicillum* Parasitic in Chickens.¹

BERTHA L. DANHEIM.

Among the internal parasites of fowls is *Ascaridia perspicillum*, a round worm one and one-half to four inches in length. It inhabits the small intestine and may be present in small or rather large numbers. Infestations ranging from ten to twenty mature worms are usually serious enough to make a visible effect upon the fowl, while thirty or more of these worms may result in the death of the chicken, due probably to the absorption of toxin produced by the worms.

That many fowls are infested in nature with this parasite is shown by the records of examinations in the parasitological laboratory during the last five years. Of a total of 424 examinations, 181 fowls, or 42.4 per cent of them, had these worms in their entrails. The smallest infestation was one and the largest seventy-five of these nematodes, the average for all infested fowls being 10.6 worms.

While this common parasite has been known for years, no careful observations of its development, of its resistance to extremes of temperature and humidity or of its means of transmission from one fowl to another have been reported. Studies on this problem were begun at this station in December, 1918, at the suggestion of Dr. James E. Ackert, under whose direction they have been continued.

The facts determined to date may be summarized as follows:

1. In *Ascaridia perspicillum* the sexes are separate, the females being somewhat larger than the males.

2. These nematodes will live in normal saline solution at laboratory temperature for at least two weeks after their removal from the body of the fowl.

3. To remove the eggs from the adult female the worm is placed in a Syracuse watch glass containing a small amount of saline solution (8 parts NaCl to 1,000 parts distilled H₂O). The body is opened with dissecting needles and the uteri are removed. By opening one end of the gorged uterus the eggs can be readily pressed out into the saline solution with a dissecting needle. They may then be left in the watch glass or transferred to culture cells.

1. From the department of zoölogy, Agricultural Experiment Station of the Kansas State Agricultural College.